(a) TITLE: CANDLE WITH LOW MELT TEMPERATURE FUEL REGION FOR EXTINGUISHING

(b) CROSS-REFERENCES TO RELATED APPLICATIONS

(Not Applicable)

(c) STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH AND DEVELOPMENT

(Not Applicable)

(d) REFERENCE TO AN APPENDIX

(Not Applicable)

(e) BACKGROUND OF THE INVENTION

1. Field Of The Invention

[0001] This invention relates generally to candles, and more specifically to a candle that extinguishes the flame before its molten fuel reaches the flashpoint temperature or can leak out and flow onto its support surface.

2. Description Of The Related Art

[0002] Candles are very popular, not only for lighting a room, but also for the scent that most candles release when burning. Because of the increase in the number of candle users and a decrease in their candle burning skills, the issue of candle safety has come to the forefront of the candle making industry.

[0003] Candlewicks function by capillary action drawing a fuel, commonly molten wax, from a molten wax pool up through the wick to the flame. The capillary action can be through a fiber or spun fiber wick or through a capillary tube. When the candle fuel pool becomes very shallow, it can become hot enough to vaporize and it no longer needs a wick to burn. This phenomenon is called "flash" or "flashover." Once the upper surface of the wax descends nearly to the floor of the container, the shallow pool of wax can be elevated above its flashpoint temperature, typically about 425°F with conventional, common waxes. During flashover, the temperature within the candle can be elevated to at least 1200°F. This excessive heat can cause glass

containers to break, and it can cause paint to scorch off the sides of metal tins and char surfaces on which they are resting.

[0004] With freestanding candles, the molten wax pool must not extend through the candle floor, because wax can flow out onto the candle-supporting surface. If the wax flows out of a freestanding candle or the container of a contained candle breaks, supporting or surrounding objects can be ignited. An additional problem is that debris in the form of carbon balls may form during burning and fall into the wax pool at the bottom of the candle, or the user may allow matches or wick trimmings to fall to the bottom. These foreign objects or debris may aggravate the flashover problem by becoming secondary wicks if the candle flame ignites them.

[0005] A sustainer is often used to provide lateral support to a wick in a candle to hold the wick in place during pouring of the wax or other fuel, and to keep the wick standing upright when the supporting wax around the wick burns very low. Traditionally, the sustainer is centrally positioned at the bottom of the candle though some manufacturers have recessed sustainers from the bottom so that candle wax, like that used to make the entire candle, fills the space beneath the sustainer.

[0006] Although rare, candles can be made to have a cavity just below the sustainer, as described in U.S. Patent No. 5,842,850, which is herein incorporated by reference. In this type of candle, the fuel melts down to the cavity, which causes the sustainer and wick to fall into the cavity, wherein the flame is extinguished by molten wax that also flows into the cavity from the molten wax pool that normally surrounds the flame of a burning candle. A candle having these qualities is not always desirable

to a consumer. The consumer is expecting to purchase a candle that is completely filled with wax and, therefore, may feel the candle is defective by having such a cavity.

[0007] Therefore, it is an object and feature of the invention to provide a safer candle for preventing or decreasing the likelihood of flashover or leakage of the molten wax onto a support surface.

[0008] It is a further object and feature to provide a candle, which has the appearance of a conventional candle but has a structural feature, which facilitates extinguishing the candle before it burns and melts all the way to the bottom of the candle fuel.

(f) BRIEF SUMMARY OF THE INVENTION

[0009] The invention is a candle having a wick surrounded by a solid fuel body. At least an upper fuel region of the solid fuel body has a first melting point and a lower fuel region of the solid fuel body has a second melting point at a lower temperature than the first melting point. The lower fuel region of the solid fuel body is positioned below the wick for extinguishing the candle.

(g) BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0010] Fig. 1 is a side view in section illustrating the preferred embodiment of the present invention.

[0011] Fig. 2 is a side view in section illustrating a partially consumed embodiment of Fig. 1.

[0012] Fig. 3 is a side view in section illustrating an extinguished flame of the embodiment of Fig. 2.

[0013] Fig. 4 is a side view in section illustrating an alternative embodiment of the invention.

[0014] Fig. 5 is a side view in section illustrating an extinguished flame of the embodiment of Fig. 4.

[0015] Fig. 6 is a side view in section illustrating another alternative embodiment of the present invention.

[0016] In describing the preferred embodiment of the invention, which is illustrated in the drawings, specific terminology will be resorted to for the sake of clarity. However, it is not intended that the invention be limited to the specific term so selected and it is to be understood that each specific term includes all technical equivalents, which operate in a similar manner to accomplish a similar purpose.

(h) DETAILED DESCRIPTION OF THE INVENTION

[0017] The preferred embodiment of the invention is a candle that has a wick 14 surrounded by a solid fuel body 10 as shown in Fig. 1-3 in various stage of operation. The solid fuel body 10 has an upper fuel region 12 that has a first melting point and a lower fuel region 16 that has a second melting point at a lower temperature than the first melting point. The lower fuel region 16 is positioned below the wick 14 for extinguishing the candle as described in more detail below.

[0018] Focusing on each of the components of the invention separately, the upper fuel region 12 is preferably made of wax that is typically used in candles, for example natural waxes, petroleum waxes or mixtures of waxes. The upper fuel region 12 has a circular cylindrical periphery, but can be any suitable candle shape. The invention is particularly desirable for a freestanding candle, such as a pillar candle. However, the candle can be formed or placed in a container that is glass, metal or other suitable candle container materials.

[0019] Within the upper fuel region 12 is a wick 14. The wick 14 is woven cotton or other fiber that functions in a conventional manner by capillary action drawing fuel from a pool of molten wax up through the wick 14 to the flame 15.

[0020] In an alternative embodiment, shown in Fig. 4, the wick 44 can be held upright within the upper fuel region 42 by a sustainer 48, which has a neck 48a with a wick bore 49 that extends from a top end of the neck 48a toward the bottom end of the neck 48a, preferably in a column-like manner. A base 48b of the sustainer 48 is flat and may have a plug 50 that closes off the wick bore 49, to prevent fuel from being pulled through the bottom 48b of the sustainer 48. However, this is only one example of a wick support used in candles. There are a variety of sustainer shapes and designs that can be used as will be recognized by a person of ordinary skill in the art. For example, the sustainer can be unsealed, not shown, which is one that is not plugged near the bottom of the wick bore.

[0021] In the preferred embodiment, shown in Fig. 1, the lower fuel region 16 of the solid fuel body 10 is also made of a wax. The wax of the lower fuel region

16 is selected to have a melting point at a lower temperature than the melting point of the wax in the upper fuel region 12. A wide range of melting points are associated with typical candle wax and can vary from 108°F to 250°F, depending on the type and amount of wax being used to make the candle. In addition, it is not unusual to blend waxes with differing melting points to form a candle. When blending of wax occurs, the blend will still have an effective melting point temperature and this invention then relates to that effective melting point temperature.

[0022] The concept of an effective melting point temperature arises by considering the concept of a melting point temperature when applied to candle fuels such as waxes and mixtures of waxes. Candles waxes are hydrocarbon compounds, which have long chain molecules and typically comprise esters and fatty acids. A wax having a single wax compound is said to be a "Narrow Cut Wax" and will have a melting point temperature at which is will change from a solid to a liquid state quickly. However, most candle waxes are " Broad Cut " or blends of multiple different wax compounds each of which may have a different melting point so the candle blend does not have a precise melting point but instead it melts over a temperature range, which is usually not noticeable to a candle user. Each component compound will melt at its melting point temperature but the blended composition as a whole will ordinarily appear to also exhibit a melting point. In doing so, as a wax is heated, its plasticity increases until finally its viscosity become so low that it will flow in a liquid manner and therefore appears to melt. The apparent melting point for a blended composition is called the effective melting point temperature. It is the

temperature at which the blend begins to flow sufficiently rapidly that it acts like a liquid wax. Consequently, in the present invention, the effective melting point temperature is the important characteristic and is referred to simply as the melting point temperature or the melting point.

[0023] The difference in melting points between the upper and lower regions 12 and 16 can encompass a broad range. It is preferred that the melting point of the wax of the upper fuel region 12 be at least about three degrees greater than the melting point of the lower fuel region 16. For example, the upper fuel region 12 can have a wax melting point of 133°F while the lower fuel region 16 can have a wax melting point of 130°F. It is more preferred, however, to have a melting point of the upper fuel region 12 at least about six degrees greater than the melting point of the lower fuel region 16. The melting point difference between the upper fuel region and the lower fuel region has a significant effect on the safety of the candle. A person of ordinary skill in the art will recognize that the given melting point temperatures and melting point temperature differences are only examples and others can be used.

[0024] The lower fuel region 16 is located axially below the wick and is cylindrical, preferably has a diameter less than the diameter of the upper fuel region 12 so it will not be visible. However, the lower fuel region 16 can be substantially the same diameter as the upper fuel region 12, as shown in Fig. 4. Additionally, the lower fuel region can be any variety of geometrical shapes and sizes, including

frusto-conical, as shown in Figs. 6, square cylindrical, or rectangular provided the lower fuel region is located below the wick.

[0025] During burning, molten wax is drawn upwardly through the wick 14 and is carried to the flame 15 where combustion occurs. During normal burning and consumption of the candle fuel of the upper fuel region 12, the upper surface of the molten wax descends as the liquid fuel is consumed, the flame descends with it and therefore melts more wax at the bottom of the molten wax pool. This process continues as both the top surface and the bottom of the molten pool of fuel continue to descend. However, with the invention, when the upper surface of the molten wax 13 descends to near the bottom end of the wick 14, as shown in Fig. 2, the flame approaches closer to the top of the lower melting temperature fuel region 16. Because the lower fuel region 16 has a lower melting point than the upper fuel region 12 and the rate of fuel consumption and the flame temperature remain the same, the rate of melting beneath the wick at the bottom of the pool increases so the bottom of the molten pool migrates downwardly at a faster rate. This increased melting rate of the lower fuel region increases the depth of the molten wax pool. The deeper pool allows the wick 14 to sink below the pool's top surface, which causes the wick to become submerged as illustrated in Fig. 3. Thus, when a significant portion of the molten wax 13 of the lower fuel region 16 is liquefied, the wick 14 is slowly submerged into the liquid wax (shown in Fig. 3) and the flame 15 is extinguished.

[0026] Similarly, if the candle has a wick and sustainer, as shown in Fig. 4, the wick 44 and sustainer 48 will submerge together and extinguish the flame as illustrated

in Fig. 5. Because most sustainers are made of an impervious, relatively heavy material, such as metal, the sustainer provides an increased downward force, like an anchor, to assist in submerging the wick. The submergence of the wick 14 into the liquefied wax prevents flashover because the flame 15 is extinguished before the depth of the molten wax gets sufficiently thin for flashover to occur. Leakage of molten wax onto a support surface is prevented because the candle is extinguished before the molten pool reaches the bottom surface of the Candle.

[0027] It is also possible to add a flame retardant to the lower melting point wax which will restrict the capillary flow of fuel or interfere with the combustion process. The prior art discloses numerous flame retarding agents which can be used in candle wax. They are typically of two types. One type is a chemical agent which flows with the molten wax fuel to the point of combustion where it acts to inhibit combustion. The second type is a particulate material which flows in the molten pool of wax to the wick but is caught against the surface of the wick and the particles cumulatively form a dam or blockage to prevent further flow to the wick. Examples of suitable flame retardants for use in candle wax or other candle fuels are extensively described in U.S. Patent Application Publications numbers 2002/0022205 and 2003/0124474.

[0028] There are many methods for making a candle in accordance with the invention. The preferred method includes extending a wick axially within a mold and forming an upper fuel region by pouring a wax with a first melting point into the mold. A void is formed in the upper fuel region below the wick either by cutting out the necessary wax to the desired void shape or by forming the void during molding

of the upper fuel region by using a mold insert having the void's shape. Finally, the candle is inverted and the void is filled with a wax that has a second melting point at a lower temperature than the melting point of the upper fuel region.

[0029] The void illustrating this method is preferably cylindrical as illustrated in Fig.1. However, a variety of shapes are available including frusto-conical as shown in Fig. 6. For example, a candle can initially be formed entirely of a higher melting point wax. A void can then be formed by drilling a hole through the bottom surface of the candle and into the upper fuel region below the sustainer. The lower melting point wax is inserted into the hole, either by pouring it in while in a molten state or by inserting a wax plug.

[0030] An alternative method for making an anti-flash candle includes attaching a sustainer to a wick and extending the wick axially within a candle mold and forming an upper fuel region that has a first melting point, by pouring wax into the mold. Alternatively, the wick can be inserted by either drilling a hole through the cooled wax and inserting the wick or by compressing wax prills around the wick. As illustrated in Fig. 4, a lower fuel region having a diameter substantially equal to the upper fuel region is formed beneath the sustainer that has a second melting point at a lower temperature than the melting point of the upper fuel region. This can be accomplished by pouring a second wax into the mold after the upper fuel region wax has cooled and solidified to provide the candle configuration shown in Fig. 4. As will be apparent to those skilled in the art, the sustainer illustrated in the embodiment of Fig. 4 is not tied to the configuration of the lower melting point region also

illustrated in Fig. 4, but can be used in any embodiment of the invention. The only requirement when a sustainer is used is that the lower melting point region be wide enough to receive the sustainer.

[0031] By providing a lower melting point wax below the wick and any sustainer, the opportunity for flashover, wax runoff and other fire hazards are greatly reduced because the candle is extinguished before it burns to the bottom of the candle. By enabling the flame to be slowly submerged into the lower melting point wax, the flame is extinguished. In addition, by filling the void with lower melting point wax instead of some other substance, such as a flame resistant plate or disk, the consumer is unlikely to notice the existence of the structure, which accomplishes the safety feature. The candles have the appearance of a conventional candle so it is more aesthetically pleasing and better meets consumer expectations. The consumer is more likely to feel that the candles purchased are standard candles and are not defective.

[0032] While certain preferred embodiments of the present invention have been disclosed in detail, it is to be understood that various modifications may be adopted without departing from the spirit of the invention or scope of the following claims.